



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

FURTHER OBSERVATIONS ON HEMOLYTIC STREPTOCOCCI IN MILK

DAVID JOHN DAVIS

From the Department of Pathology and Bacteriology, University of Illinois, College of Medicine, Chicago

In a previous paper¹ I presented data obtained from the analysis of milk samples from nine different dairies in the city of Chicago. Of 328 specimens examined hemolytic streptococci were found in 85. Forty-five of the 328 specimens were certified milk, the remainder being pasteurized, some by the flash method, others by the holding process. Forty per cent. of the certified samples yielded hemolytic streptococci. The number of pasteurized samples yielding hemolytic streptococci varied greatly among the different dairies. Sixteen samples from one yielded none. The others gave positive results varying from 6-45% of the samples examined. A discussion of the heat resistance, virulence and other properties of these streptococci are given in the paper. No definitely virulent organisms were met with though a number of strains in moderate doses caused lesions in the joints of animals.

Since then further examination of samples of both certified and pasteurized milk from a certain dairy indicated the presence of hemolytic streptococci commonly in the former, very rarely in the latter. A more systematic study, therefore, has been made of both certified and pasteurized samples from the dairy for the presence of this type of streptococci. It should be stated that the certified milk and the pasteurized milk came to the distributing dairy from entirely different sources. The difference between them therefore may not be merely one of pasteurization.

The examinations were made during January, February and March. The milk coming to the laboratory was plated as soon as possible and, in case there was delay, the specimens were placed in a good refrigerator. Definite amounts were measured in sterile pipets and agar plates made. These were then incubated and the results recorded after 48 hours.

Ninety-two samples, 46 pasteurized and 46 certified, were examined. Total bacterial counts were made in 20 of each. The plate counts in the certified specimens ranged from 2,000-15,000 per c.c., those in the pasteurized specimens from 10,000-45,000 per c.c.

Received for publication June 26, 1918.

¹ Jour. Infect. Dis., 1916, 19, p. 236.

Hemolytic streptococci (colonies surrounded by a clear, wide zone of hemolysis) were isolated in one of the 46 pasteurized specimens, their number in this instance being 20 per cc of milk. Of the 46 certified samples, 22 yielded hemolytic streptococci on the blood plates, their number ranging from 8-2,400 per cc of milk.

These strains of streptococci were all practically alike in their hemolytic action, producing clear zones from 1-3 mm. across. The colonies themselves were small and gray. In plain broth they usually grew well and caused an early turbidity which later cleared by sedimentation. They all rapidly acidified and coagulated milk in 24 hours. The milk became first pink, then, especially at the bottom of the tube, very pale; later only little color remained. Morphologically the cocci appeared in pairs or short chains. In fluid mediums they at times tended to form long chains, there being considerable variation in this respect. The cocci, as a rule, are slightly elongated, Gram-positive and not encapsulated.

Twelve of the most typical strains were grown for 24 hours in serum broth (1-4), 2 cc of which was inoculated into the ear veins of young rabbits of approximately 1,000 gm. With this dosage 2 of the strains were pathogenic for the rabbits. One strain (C-16) after several days caused an infection of the left knee which at the end of 2 weeks was large and fluctuating and on aspiration yielded the streptococci. No other lesions appeared and the animal lived several weeks without further manifestations. The other strain (C-19) after 3 days caused an involvement of the left wrist and right knee joint and death 5 days after the injection. There was congestion with numerous hemorrhages in the cecum, also small hemorrhages in the endocardium and the chordae tendineae of the right heart. Definite endocarditis was not present. There was marked joint and tendon involvement of the extremities, especially the left fore and right hind foot. Small hemorrhages appeared at various points along the spinal cord and also in the meninges. From various joints, the heart blood and spinal cord pure cultures of the hemolytic streptococci were grown.

A few drops of a 24-hour ascitic-broth culture of the same organism was introduced intraperitoneally in a white mouse, which died 4 days later of a streptococcic septicemia. Four other strains injected similarly into white mice produced no effect.

It is evident that this strain was decidedly more virulent for animals than the other strains of the series, though in milk and otherwise it was quite like them. The other strains in the dosage stated produced no lesions, and even in considerable larger doses were quite without virulent properties. It is to be noted that in large doses (5-15 cc ascites-broth culture) given intravenously in young rabbits, these hemolytic streptococci invariably localize in various tissues and cause local lesions. The joints are a common site of infection as is also the region of the cecum.

All the streptococci described apparently belong to the hemolytic streptococci of bovine origin which I described in my previous paper. They are not as a rule virulent for animals as are those of human origin and on milk they behave quite like *streptococcus lacticus*. Indeed, excepting the hemolytic property they are practically identical with this organism which usually reveals a definite green coloration on blood without appreciable hemolysis. My observations, as pointed

out before, therefore indicate that there are both hemolytic and non-hemolytic lacticus strains both of which are nonvirulent, active acidifiers and coagulators of milk.

The hemolytic streptococci so often found in milk, especially non-pasteurized, are readily distinguished from the human varieties by their behavior in milk. But it should be pointed out that occasionally in milk occur varieties of hemolytic cocci quite like the human. Such sometimes occur in the udders and may be the cause of epidemics of sore throat. Probably not all strains of such organisms are capable of causing such epidemics any more than are all strains of streptococci of different human origins. At any rate hemolytic streptococci are found in milk from diseased udders which are quite different from the hemolytic milk streptococci of the lacticus type.

I may repeat what I have emphasized¹ that in milk there are strongly hemolytic streptococci of the lacticus type which are probably of no pathogenic significance to man, and hemolytic streptococci quite like the human varieties and which may or may not be highly pathogenic for man. They are probably directly or indirectly human in origin.

SUMMARY

Further observations have revealed the presence of hemolytic streptococci of the lacticus type in dairy milk in 23 of 92 samples.

In this series they were far more common in nonpasteurized than in pasteurized milk.

They are less virulent for rabbits than the hemolytic streptococci of human origin. Two strains were found with moderate pathogenic power for rabbits.

While, in general, one may be practically sure that organisms of the lacticus type are not dangerous to man, still individual organisms or strains of human, milk or bovine origin suspected of being responsible for sore throats or other infections in man should be carefully studied and compared with a view to finding specific common characters.